

Painting Plastic Components with Greater Transfer Efficiency



About Mueller Electric:



Ever since Ralph Mueller invented the “alligator clip” back in 1908, the Mueller name has been synonymous with quality, durability and reliability. Throughout the years, Mueller’s attention has remained squarely focused on the quality aspects of its products.

**“Mueller products
outlast all others and
cost less, because they
last.”**

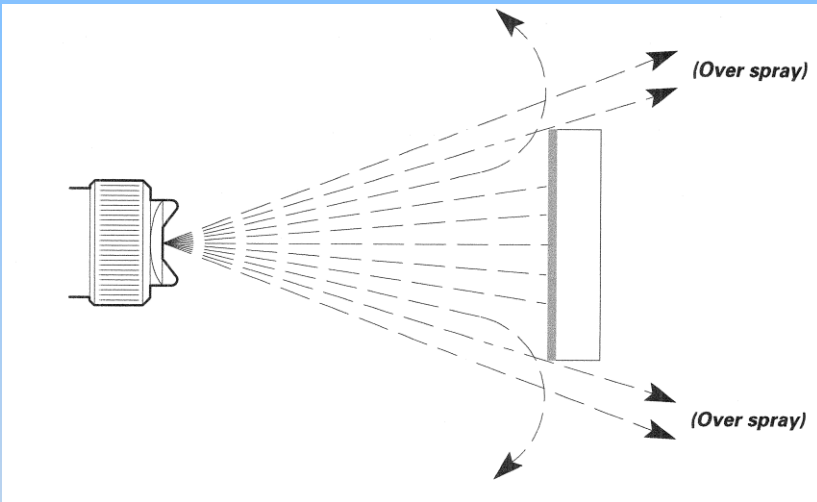
Mueller offers a broad and comprehensive line of both standard and custom products.

- Custom cable assemblies
- Grounding Solutions
- Heavy Duty Clips & Insulators
Connectors
- Test & Measurement
Products
- Wire & Cable
- Packaging

Mueller’s engineering and application support ensures the right product for a reliable & cost-effective solution.

1 Plastic Painting Transfer Efficiency

Painting plastics is never an easy task considering all the technical, material, and environmental variables throughout the process. When we talk of paint transfer efficiency, we are referring to the spray (painting) finishing process, which measures the amount of paint material adhering to the paint target in comparison to the amount of paint material that was sprayed through the paint applicator towards the paint target.



Thus, the transfer efficiency, is expressed in terms of a percentage. For example, of the paint sprayed from the applicator, what percentage of the material actually lands on the target? If we calculate a measurement of 75% transfer efficiency, then 75% of the paint sprayed landed on the target. The remaining 25%

landed elsewhere like the floor, walls or even your shoes. There are several factors that impact transfer efficiency including the spray equipment being used (including air and fluid pressure), ambient temperature, humidity, and moving air in the paint area. Additional factors include the actual shape and size of the paint target itself, spray finishing methods including atomization and the individual or robots operating the spray applicator. Finally, the electrical conditions of the applicator, paint material, plastic target and holding fixture/carrier is very important and impacts both the paint transfer efficiency and the paint quality of the component. This paper will focus on this portion of the painting process and provide insight as to grounding methods and the control of electrostatic charges.

2 Expanded Use of Painted Plastic Components for Lower Costs & Improved Fuel Efficiencies

With the growing need to lower costs and improve fuel efficiencies, plastics are being increasingly used in automobiles, construction equipment, recreation vehicles, off-road vehicles and power equipment. The need to paint these plastic components has increased as well. In automotive, plastics make up approximately 50% of the components, typically over 250 pounds, but contributes to only 10% of its overall weight.¹



This has played a significant role in lowering fuel consumption. In fact, for every 10% that an automobile's weight is reduced, fuel efficiency increases by 6% to 8%. Automotive designs use plastics in front and rear bumpers, side doors, seatbelts, rear hatches, airbags, dashboards, headlight and side view mirror housings, grilles, wheel covers and even in some drive shafts. The majority of these plastic components require painting prior to vehicle assembly.

2

Expanded Use of Painted Plastic Components to Simplify the Production Process & Design Flexibility



Regarding off-road or recreation vehicles and equipment, plastics are being used increasingly in bicycles, motorcycles, ATVs, roller skates, canoes, skis and even athletic shoes. Boats and other watercraft use plastics in sails, rudders, dagger boards, center boards, slats, spars, wings and hulls. The aviation industry has incorporated plastics into their aircraft designs for many years for weight reduction and enhanced fuel efficiency. Improved plastic designs and compounds have added strength and structural integrity to plastic parts, enabling them to replace heavier components. Plastics often simplify the production process, are more flexible in design, and are generally easier to tool.²

The proper grounding of electrostatic charges in the plastic painting process is crucial not only for Paint Transfer Efficiency, but for the minimization of part scrap and rework, which can add significant cost to the process. With this, more attention has been directed at optimizing paint process grounding and made part of process improvement program objectives.

2 Paint Process Efficiency – Reduction of Scrap & Rework - Importance of Proper Electrostatic Discharge

A target with an electrostatic charge cause paint to flow unevenly, or even repel paint, thus reducing the transfer efficiency and increasing the potential for part defects. If the electrostatic polar charge of the paint and plastic component are the same, the two materials will repel. When this occurs, paint spray will be propelled unevenly around the target, creating uneven patterns, and inconsistencies. A metallic base amplifies this effect.

When an electrostatic grounding issue occurs during paint application, the painted plastic component may need to be scrapped or reworked, which is a costly and time-consuming event. Scrap and rework costs vary on the component itself. The rework of a painted vehicle bumper can be in the \$150 range. Scrapping the same bumper may cost \$500 or more.³



2

Paint Process Efficiency – Reduction of Scrap & Rework - Importance of Proper Electrostatic Discharge

Some painting facilities and departments use foil underlining for grounding in the plastics painting process. Foil creates a grounding bond through the holding fixture or carrier used to carry the plastic components through the paint line. Although foil underlining is moderately effective, it can be messy, particularly if the foil covers a large spray area. Paint accumulations on the foil can build up quickly requiring regular foil replacement, which is costly in terms of materials and labor resources.

Foil creates a grounding bond, but can be messy, prone to damage and require frequent replacement thereby, adding cost and unnecessary effort.

Foil breakage or damage is another factor causing a high rate of foil replacement. When foil integrity is compromised, the distribution or dissipation of the electrostatic charges may be altered, reintroducing the potential for costly rework or scrap.

Alternate solutions, other than foil, include: 1) the use of electrical clips and wire assemblies; and 2) the use of a system that applies an electrostatic charge to the paint itself and is integrated with the process's grounding equipment. Both of these alternate solutions are effective in improving transfer efficiency, with fewer drawbacks.

3

Paint Process Efficiency – Reduction of Scrap & Rework in the paint process ...continued

Electrostatic Grounding Systems: How much do they cost you to operate and maintain?

Each grounding method (charged paint/target; foil underlining; grounding clip assembly) improves paint transfer efficiency to varying degrees and thus the quality and process consistency of the painted plastic components. The next question to be asked is: Are the Scrap and Rework savings realized through effective electrostatic grounding being eroded by the costs to operate and maintain those systems? Costs to be considered include:

- **INVENTORY:** What are the associated costs to purchase individual grounding components, and to monitor/maintain inventory levels?
- **LABOR:** What are the associated costs to build assemblies in-house, using your own staff, as opposed to buying a complete assembly?
- **SET-UP/CLEAN-UP:** What are the costs of set-up and clean-up?
- **EFFECTIVENESS & EASE OF USE:** Is the grounding method reliable, repeatable, reusable & cleanable?

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Paint Process Efficiency – Reduction of Scrap & Rework in the paint process ...continued

Ironically, and perhaps counter-intuitive, purchasing a complete, fully-assembled grounding solution is the lowest cost option.

Why?

- Grounding Assemblies can be customized to the exact requirements of your process. Each is precisely made and consistent
- The cost of a finished Assembly is LESS than the cost to purchase individual components and build yourself with in-house labor
- No scrap, broken or missing parts. Assemblies arrive ready-to-use
- Less administrative cost to order, stock, receive and count. Fewer SKUs
- A professional evaluation will help optimize your process



4 Grounding Solutions from Mueller Electric

ELECTROSTATIC GROUNDING OPTIONS BY MUELLER ELECTRIC...

Mueller Electric stocks over 300 standard clip configurations, which are used in a wide variety of both industrial and test/measurement applications. Mueller is well-known for its grounding clip product line. Many OEMs purchase Mueller's heavy-duty, durable clips for their exceptional service life. Requirements for an electrostatic grounding clip, used in painting processes, are somewhat different than other industrial clips. **The design goal of an electrostatic grounding clip is to balance functionality, durability, and cost.** Since electrostatic grounding clips are subjected to a harsh environment (paint buildup; cleaning solvents), these products need to reliably perform their function for their intended life, and withstand cleaning, yet be inexpensive enough to discard and replace on an interval that serves the requirements of the process.

As previously discussed, Paint Transfer Efficiency is important, and has many variables. Electrostatic discharge through proper grounding is one of those variables. If properly controlled, the benefits will be realized in a more uniformly coated part, in reduced rework, and in lower scrap rates. **It's not a question of whether or not to ground your process, rather how it will be done and the total cost of that method.**

4 Grounding Solutions by Mueller Electric

Mueller Recommends two **Cost-Effective** solutions:

1. Purchase a standard, pre-fabricated assembly that is ready-to-use; or
2. Design & spec your own custom assembly to perfectly meet the needs of your process (specify each clip connector style & size; select wire type & length; etc.)

Mueller's application engineers will evaluate your process and walk you through the options. Once an option is selected, samples can be requested for process testing.



Popular BU-113 Grounding Clip used in pre-fabricated assemblies

Continue reading for a description and examples of each cost-effective solution...

4

Grounding Solutions from Mueller Electric

Pre-Fabricated Electrostatic Grounding Assembly:

This is Mueller's most cost-effective solution. One part number to order and monitor. Open the box, ready to use! The clip ends, wire lengths, and other requirements are selected during Mueller's review of your process.

Pre-Fabricated Assembly Example 1: Mueller's AI-000422 assembly has become the workhorse of painted plastic component grounding, especially on parts that are prone to visual defects and rework. This assembly is particularly good at controlling electrostatic charges with metallic paint processes. The quick-disconnect design of the BU-118 enables the clip to gently slide off the painted component. The clip's "duck-bill" design additionally offers a large conductive contact area, ensuring a solid grounding connection and firm, non-damaging grip.



The AI-000422 grounding assembly shown above includes an 18" length (custom lengths available) of stainless steel braided wire rope with BU-118 clips on each end. This assembly is commonly used in applications requiring either one grounding point per each component; or applications with one grounding point per multiple components that are ganged together.

4

Grounding Solutions from Mueller Electric

Pre-Fabricated Assembly Example 2: Mueller's AI-000443 is used in fully-automated part painting processes that require a rugged connection on the discharge end of the assembly, with a part-friendly "duck-bill" clip (BU-118) on the plastic component side. In fully-automated processes, parts to be painted are placed in a holding fixture or parts carrier. The rugged connection clip places on the discharge side of the assembly is securely attached to the grounding point, with little risk of accidental disconnection. The "duck-bill" (BU-118) clip is used on the opposite end of the assembly for quick-disconnect and damage-free dismount of the painted part. The automobile industry uses this type of grounding assembly on their fully-automated, robotic processes used to paint front and rear bumpers.



Pictured above, the AI-000443 assembly, with a BU-118 clip attached at one end, and the more rugged BU-27 clip is attached to the opposite end. An 18" length of stainless steel braided wire rope is shown. Custom wire lengths are available.

4

Grounding Solutions from Mueller Electric

Pre-Fabricated Assembly Examples 3A & 3B: Used in applications requiring highly-reliable, rugged clip connection on both sides of the assembly. The clip end connections offer extra-firm placement, making them less vulnerable to inadvertent disconnection during the paint process. These heavy-duty assemblies additionally offer excellent electrostatic grounding properties, enhancing paint transfer efficiency.



Pictured above, the AI-000441 assembly utilizes BU-27 clips on both ends of an 18" length stainless steel braided wire rope, with custom lengths available.



The AI-000448 assembly utilizes BU-24 clips on both ends of an 18" length stainless steel braided wire rope, with custom lengths available.

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Grounding Solutions from Mueller Electric

Design & Spec your own Custom assembly to Perfectly meet the Requirements of your Process

For those of you who are intimately familiar with your process and already know what works and what doesn't work, we invite you to custom design and spec your own assembly. Mueller helps with:

- A comprehensive in-stock inventory of clips & cables to mix-and-match
- Sample units to test & validate on your process
- “Ready-to-Use” assemblies, delivered OEM direct or through your preferred supply chain partner



5

Summary & Getting Started

SUMMARY

In summary, there are many methods for addressing electrostatic grounding in plastics painting processes. Selection of the best method for your process is a simple and worthwhile exercise that consumes little of your time and provides a return in time and cost.

Mueller Electric's friendly and knowledgeable staff will guide you through the steps, including process analysis, applications engineering, and test sample procurement.

Benefits for your small investment in time...

- improved part consistency
- reduced rework
- lower scrap levels
- labor savings
- lower overall costs.

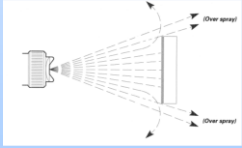
To get started, please contact us:



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6

References & Acknowledgements



Transfer Efficiency, Graco, Inc.

1 – Automobile Safety Using Plastics, Plastics Make it Possible

2 – Plastics in Transportation, The Plastics Industry Trade Association

3 – TA Industrial, Toledo, OH



Super Plastic Paint #4 Painting ATV Plastic,
www.newsonair.org



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What is Bumper Recycling, Polyvance



www.eisenmann.us.com



Paint Shops for Plastics



Paint Engineering Services, paintengineering.in